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# MOISTURE AND ALTITUDE AS FACTORS IN DETERMINING THE SEASONAL ACTIVITIES OF THE TOWNSEND GROUND SQUIRREL IN WASHINGTON

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The Townsend Ground Squirrel, *Citellus townsendi,* Bachman (Fig. 1, Type Locality Walla Walla, Washington), is a small dust-colored, brown-nosed, crop-eared, short-tailed ground squirrel, now inhabiting the Snake and Columbia River regions of Eastern Washington. It is said by early settlers to have extended over these lower countries of the Big Bend, up into the higher bunch-grass altitudes of the Palouse Country from which it has been slowly driven by the larger species, the Columbian Ground Squirrel, *Citellus columbianus.*

The activities of this animal are controlled to an unusual degree by such climatic conditions as high temperature and lack of moisture. Its move-

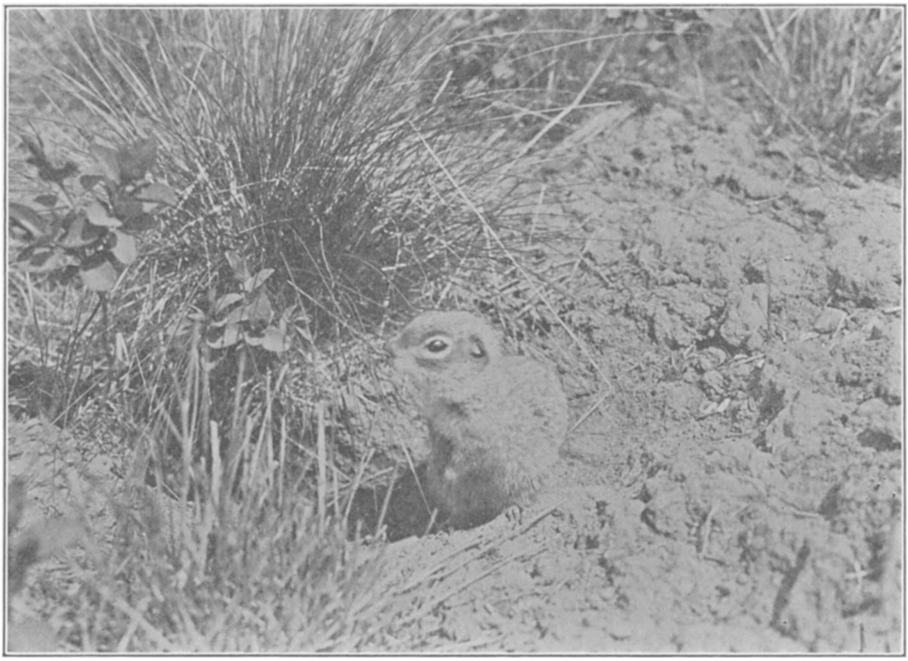

Fig. 1. Townsend ground squirrel at the entrance of its burrow in a bunch grass situation. From life.

ments are clearly restricted by altitude, which in many parts of the State of Washington changes rapidly and suddenly; for where splendid mountain ranges have not abruptly risen from the level of the sea to Alpine zones, young river courses have gradually eaten through the thousands of feet of basalt stratification of the Great Columbia Basin, carrying the Upper Sonoran of sea level far into the interior plateau country. It is with conditions such as we find in the Snake River Canyon that we have undertaken this study.

Dropping suddenly from the high ranges of the Bitter Root and Rocky Mountains of Idaho and Wyoming, the Snake, swollen by many snow-fed mountain tributaries to proportions of a stately river by the time it reaches Washington, has cut through the age-old strata of basalt, until at Wawawai, in the southeastern part of the State, it is but 600 feet above sea level, and here its gently receding canyon walls enjoy a mild Sonoran winter. A warm chinook, a ray of sun and the canyon sides take on fresh tints of spring and in due time hasten on to an early harvest. This is in strange contrast to the winter-swept landscape just over the rim; for at Pullman, less than fifteen miles away (elevation 2,536 feet), the hills of the Palouse may still be snow spread, and most forms of life hibernal.

To this locality by the Snake River we went on January 28, 1914. At Pullman the average temperature for the month was 35.02 degrees, with a precipitation of 16 inches of snow and 2.5 inches of rain, and no signs of *Citellus* life appearing before February 21. On the lower slopes of the Snake River, at an elevation of 900 to 1,500 feet, numerous Townsend ground squirrels had already been out some days before our arrival; for not only were they showing signs of mating, but pregnant females brought back for study produced young on February 8, thirteen days before any Columbian ground squirrels at Pullman appeared from hibernation.

By March 22, only 12 days after the snow had left the ground at Pullman, young Townsend ground squirrels at Wawawai had come from their brood nests. At Pullman no young of the Columbians appeared before May 10.

This low Sonoran belt at Wawawai has, too, an early harvest. By the middle of June the country has lost its freshness of spring and taken on the yellow maturity of fruition. In these June days the air rises up hot from the parched earth. It is the time of ripening abundance for Townsendi.

Standing among the tufts of bunch grass and lupines, in the breathless stillness of the heat of a mid-June afternoon, listening to the sharp snap of the drying lupine pods hurling their ripened seeds across the waiting breast of their sleeping mother, one is impressed strongly with the solitude of the wilderness. Even the Townsendi are impressively silent, and the ear would miss and the eye overlook them if it were not for the dry, shaken, rustling seed-laden plant tops upon which they work. How wonderfully they heed the order of events! On June 14 they were observed gathering food from the little Alfilaria, *Erodium,* the maturing seeds of which were eagerly sought by them, for this is the season nearing their aestivation—they are now accumulating fat from this nutritious food. Wind and sun, two persistent desiccating agents, have spirited away the scant sap supply from ripening vegetation, and now, deprived of moisture, they would perish even in the presence of an abundance of food were not the peril, even in midsummer, met by aestivation. By July 4 no squirrel is left; one may search the slopes in vain. Wild meadows, scarcely a dozen days ago populous with them, are now silent even to the wind-rasp of parched leaf. Yet hardly a dozen miles away the Palouse fields about Pullman have barely passed the richness of their growing green, and the species of *Citellus* there has only reached the high mark of its seasonal activity.

A most interesting and instructive example of the profound influence of conditions brought about by altitude was shown in the case of a Townsend squirrel taken at La Cross, Washington (elevation 1,471 feet), and observed under favorable condition at Pullman, 1,000 feet higher. True to his ancestral habits, when June came around he became restless and showed signs of preparation for aestivation. From day to day his appetite diminished and on the fourteenth of the month he ceased activities permanently, quite

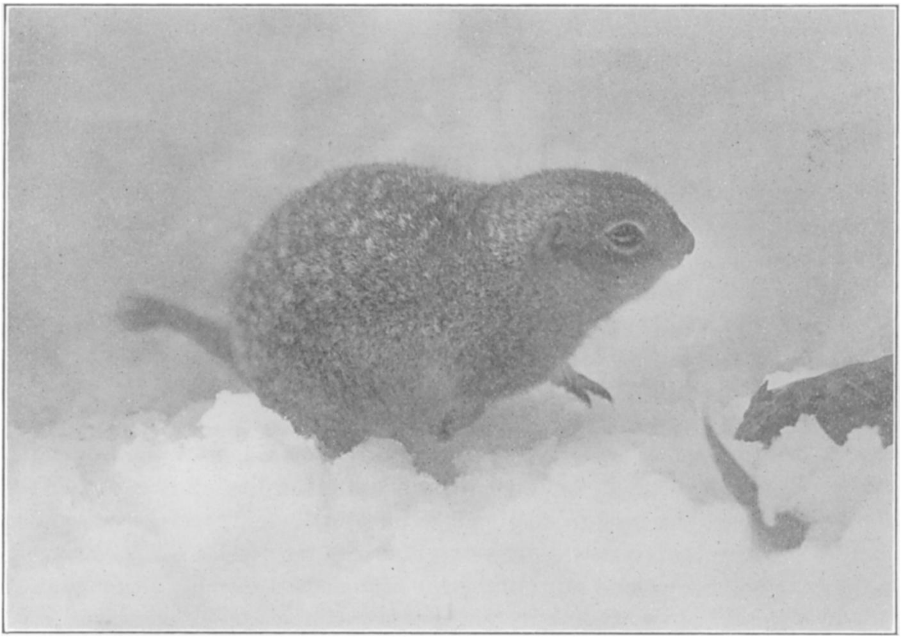

Fig. 2. Townsend ground squirrel one month after awakening from hibernation. Photographed at Pullman, March 13, 1913, from life.

two months before the last *Citellus* at Pullman had disappeared; nor did he resume active life again until the last days of January, when succulent vegetation had returned to his native bunch-grass fields. What must have been his surprise at Pullman to awaken beneath cold banks of snow! Little daunted, however, having seen his shadow, so to speak, he returned again to the profound quiescent stage of hibernation, from which he did not return for more than ten days. On February 13 he reappeared, and, finding conditions more like those at home, took up active life for the season (fig. 2). During this aestivation and hibernation he had been most of the time inactive, without food for 244 days, or, roughly speaking, eight months. The following year he awoke permanently on January 9, in harmony with his native La Crosse conditions.

So surely have the observations of one season been confirmed by those of the following season that little doubt is left as to the influences of moisture and altitude on these animals.